

Safety Data Sheet

1,1-Dimethyl- ethylenimine

Division of Safety
National Institutes
of Health



WARNING!

THIS COMPOUND IS ABSORBED THROUGH THE SKIN AND THE RESPIRATORY AND INTESTINAL TRACTS. IT IS TOXIC AND CARCINOGENIC AND CAUSES SEVERE IRRITATION OF SKIN AND EYES. AVOID FORMATION AND BREATHING OF AEROSOLS OR VAPORS.

LABORATORY OPERATIONS SHOULD BE CONDUCTED IN A FUME HOOD, GLOVE BOX, OR VENTILATED CABINET.

DMEI IS FLAMMABLE AND EXPLOSIVE. KEEP AWAY FROM SPARKS AND OPEN FLAMES. IN CASE OF FIRE, USE CARBON DIOXIDE OR DRY CHEMICAL EXTINGUISHER.

AVOID SKIN CONTACT: IF EXPOSED, WASH WITH SOAP AND WATER.

FOR EYE EXPOSURE, IRRIGATE IMMEDIATELY WITH LARGE AMOUNTS OF WATER. FOR INGESTION, DRINK WATER OR MILK. FOR INHALATION, REMOVE VICTIM PROMPTLY TO CLEAN AIR. ADMINISTER RESCUE BREATHING IF NECESSARY. REFER TO PHYSICIAN AT ONCE.

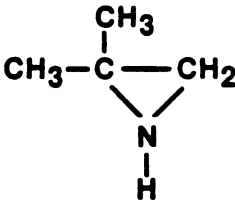
IN CASE OF LABORATORY SPILL, WEAR PROTECTIVE CLOTHING DURING CLEANUP. AVOID SKIN CONTACT OR BREATHING OF AEROSOLS OR VAPORS. WASH DOWN AREA WITH WATER. DISPOSE OF WASTE SOLUTIONS AND MATERIALS APPROPRIATELY.

A. Background

Dimethylethylenimine (DMEI) is a volatile, flammable, reactive liquid. It may be absorbed through the skin and is presumably toxic by all routes. It may cause skin irritation and blistering and eye and respiratory irritation. The vapors are flammable and may be explosive when exposed to a spark or open flame. An inhalation hazard may exist when handling solutions.

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Chemical and Physical Data

1. Chemical Abstract No.: 2658-24-4
2. Synonyms:
DMEI 2,2-Dimethylethylenimine
2,2-Methylaziridine 2,2-Dimethylethyleneimine
2,2-Dimethylaziridine (9CI)
3. Molecular formula: C_4H_9N
weight: 71.12
structure:

CC1(C)CN1C
4. Density: 0.7840 g/cm³ at 25°C relative to water at 25°C.
5. Absorption spectroscopy: No data.
6. Volatility: 75 mm Hg at 20°C (estimated from boiling point). The concentration of the saturated vapor is approximately 10% or 100,000 ppm.
7. Solubility: Soluble in water and most organic solvents.
8. Description, appearance, and odor: Colorless, volatile liquid with an ammoniacal odor.
9. Boiling point: 69-70°C.
Melting point: -47°C.
10. Stability: Thermally stable. Polymerizes rapidly in presence of acid (store over NaOH pellets). Hydrolyzes slowly in aqueous solution. Decomposed by UV light.
11. Chemical reactivity: Highly reactive. Ring-opening reactions catalyzed by acid are exothermic, though not as violent as those of ethylenimine.
12. Flash point: Unknown, but the liquid should be considered a fire hazard.
13. Autoignition temperature: Unknown.
14. Flammable limits: Unknown.

Fire, Explosion, and Reactivity Hazard Data

1. Use carbon dioxide or dry chemical fire extinguisher. Fire-fighting personnel should wear air-supplied respirators with full-face masks.
2. The vapors can explode when sparked.
3. Acids, some metals, and chloride ion can catalyze an exothermic polymerization reaction.
4. Incompatible with water. In the presence of acids, copper alloys, and silver alloys, decomposition may be explosive.
5. Nitrogen oxides may be produced on incineration.
6. Do not expose to spark or open flame.

Operational Procedures

The NIH Guidelines for the Laboratory Use of Chemical Carcinogens describe operational practices to be followed when potentially carcinogenic chemicals are used in NIH laboratories. The Guidelines should be consulted to identify the proper use conditions required and specific controls to be implemented during normal and complex operations or manipulations involving DMEI.

1. Chemical inactivation: No validated method reported.
2. Decontamination: Turn off equipment that could be affected by DMEI or the materials used for cleanup. If more than 100 ml has been spilled or if there is any uncertainty regarding the procedures to be followed for decontamination, call the NIH Fire Department (dial 116) for assistance. Wash surfaces with copious quantities of water. Glassware should be rinsed (in a hood) with an organic solvent, followed by soap and water. Animal cages should be washed with water.
3. Disposal: No waste streams containing DMEI shall be disposed of in sinks or general refuse. Surplus DMEI or chemical waste streams contaminated with DMEI shall be handled as hazardous chemical waste and disposed of in accordance with the NIH chemical waste disposal system. Nonchemical waste (e.g., animal carcasses and bedding) containing DMEI shall be handled and packaged for incineration in accordance with the NIH medical-pathological waste disposal system. Potentially infectious waste (e.g., tissue cultures) containing DMEI shall be disinfected by heat using a standard autoclave treatment and packaged for incineration, as above. Burnable waste (e.g., absorbent bench top liners) minimally contaminated with DMEI shall be handled as potentially infectious waste and packaged for incineration, as above. Absorbent materials (e.g.,

associated with spill cleanup) grossly contaminated shall be handled in accordance with the chemical waste disposal system. Radioactive waste containing DMEI shall be handled in accordance with the NIH radioactive waste disposal system.

4. Storage: Store DMEI stock quantities in a flammable storage cabinet over pellets of NaOH, in screw-capped vials or bottles with Teflon or conical polyethylene liners, or in ampoules.

Monitoring and Measurement Procedures Including Direct Field Measurements and Sampling for Subsequent Laboratory Analysis

1. Sampling: For air sampling, the Drager multi-gas detector (using the hydrazine tube) and the Mine Safety Appliance universal testing kit with DMEI tube have been evaluated (Dow, 1976). The latter is more accurate but not as fast or as sensitive as the Drager device. Direct air sampling into Folin's reagent with subsequent extraction is an efficient method provided the author's directions are followed exactly (Crompton, 1965). For water sampling, extract with chloroform.
2. Separation and analysis: The most sensitive and rapid method is HPLC, with lower limits of 0.01 ppm in aqueous solution (Evans et al., 1975). Other methods are GC and colorimetry (Crompton, 1965; Epstein et al., 1955).

Biological Effects (Animal and Human)

NOTE: There are no data in the literature concerning the biological effects of DMEI; however, there are several reports on animal and clinical trials with complexes of DMEI with chemically attached "bulky" groups such as urethanes, which release DMEI on hydrolysis in vivo. These drugs have been used in cancer chemotherapy.

1. Absorption: DMEI complexes are absorbed on oral administration. Free DMEI is probably absorbed also through the skin, eyes, and respiratory tract.
2. Distribution: DMEI complexes are distributed throughout the body and cross the blood-brain barrier.
3. Metabolism and excretion: No data. It is likely that major metabolites are 1,1- and/or 2,2-dimethyl-2-aminoethanol.
4. Toxic effects: No data on acute LD50. Comparison of LD50s of ethylenimine and DMEI complexes indicates that DMEI is one fifth as toxic as ethylenimine. In human chemotherapy trials, 1 g of a DMEI complex per day for 10 days was tolerated without unacceptable toxicity.

5. Carcinogenic effects: No data. As mentioned above, DMEI complexes have been used in cancer chemotherapy (e.g., in the management of bronchogenic carcinoma). Free DMEI (by analogy with other aziridines) may be expected to produce hepatomas and pulmonary tumors.
6. Mutagenic and teratogenic effects: No data. DMEI, like other aziridines, is probably mutagenic.

Emergency Treatment

1. Skin and eye exposure: For skin exposure, remove contaminated clothing and wash skin with soap and water for 15-30 minutes; burns may be delayed several hours. For eye exposure, irrigate immediately with copious quantities of running water for at least 15 minutes. Obtain ophthalmological evaluation.
2. Ingestion: Drink plenty of water or milk.
3. Inhalation: Remove victim promptly to clean air. Administer rescue breathing if necessary. Inhalation or ingestion may produce nausea, vomiting, cough, and lung irritation. Symptoms may be delayed. Exposure with or without symptoms requires hospitalization for observation and treatment. Difficulty in breathing requires oxygen on the way to the hospital.
4. Refer to a physician at once.

References

- Crompton, T.R. 1965. Determination of traces of ethylenimine monomer in samples of air. *Analyst* 90:107-111.
- Dow Chemical Company. 1976. Technical Aspects--Ethylenimine. Midland, Michigan.
- Epstein, J., R.W. Rosenthal, and R.J. Ess. 1955. Use of γ -(4-nitrobenzyl)-pyridine as analytical reagent for ethylenimines and alkylating agents. *Anal Chem* 27:1435-1439.
- Evans, D.J., R.J. Mayfield, and I.M. Russel. 1975. Rapid estimation of trace amounts of ethylenimine by high pressure liquid chromatography. *J Chromatogr* 115:391-395.